



# Track 3: IoT experimentation

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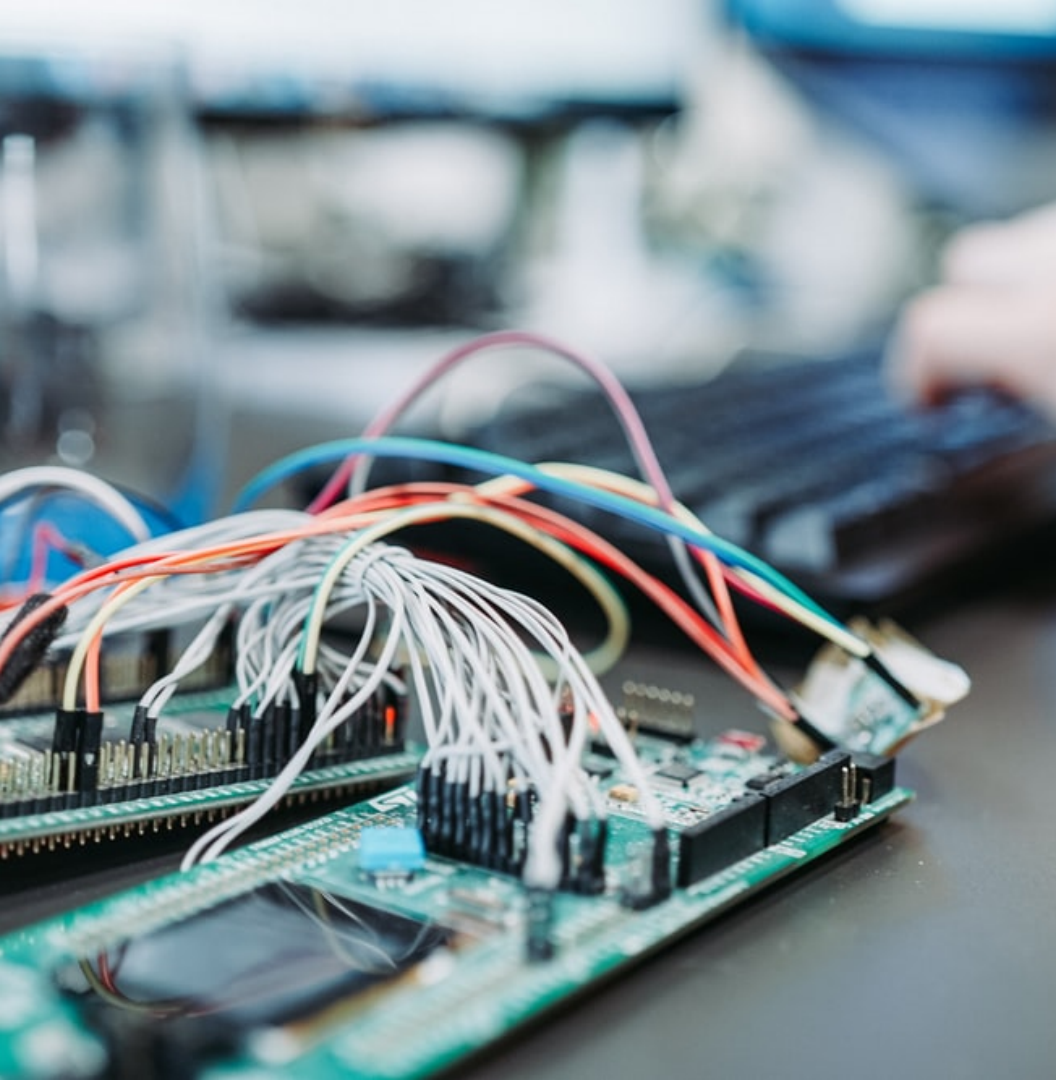
*imec – Ghent University, Belgium*

Porto Roadshow

*Porto - February 18, 2020*

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## Available hardware for IoT Experimentation

# Testbeds providing IoT Hardware



w-iLab.t

imec, Belgium

Portable Wireless  
Testbeds

imec, Belgium

CityLab

imec, Belgium

Smart  
Santander

UC, Spain

LOG-a-TEC

JSI, Slovenia

MORE INFO: <https://www.fed4fire.eu/testbeds/>

# Overview of w-iLab.t

## W-ILAB.2

100+ fixed wireless nodes  
and 16 robots in a 60x20m  
pseudo shielded room



## W-ILAB.1

150+ nodes in real office  
environment



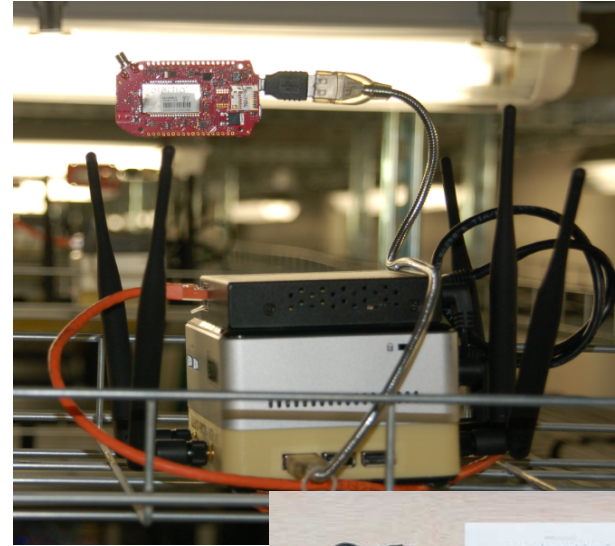


# w-iLab.1 node in detail

150+ nodes spread over  
3 office floors

Intel NUC D54250WYKH with:

- 2x WIFI:
  - 1x 802.11abgn+BT
  - 1x 802.11ac
- 1 or 2 Zolertia Re-Mote sensor
  - Controlled via Yepkit USB hub

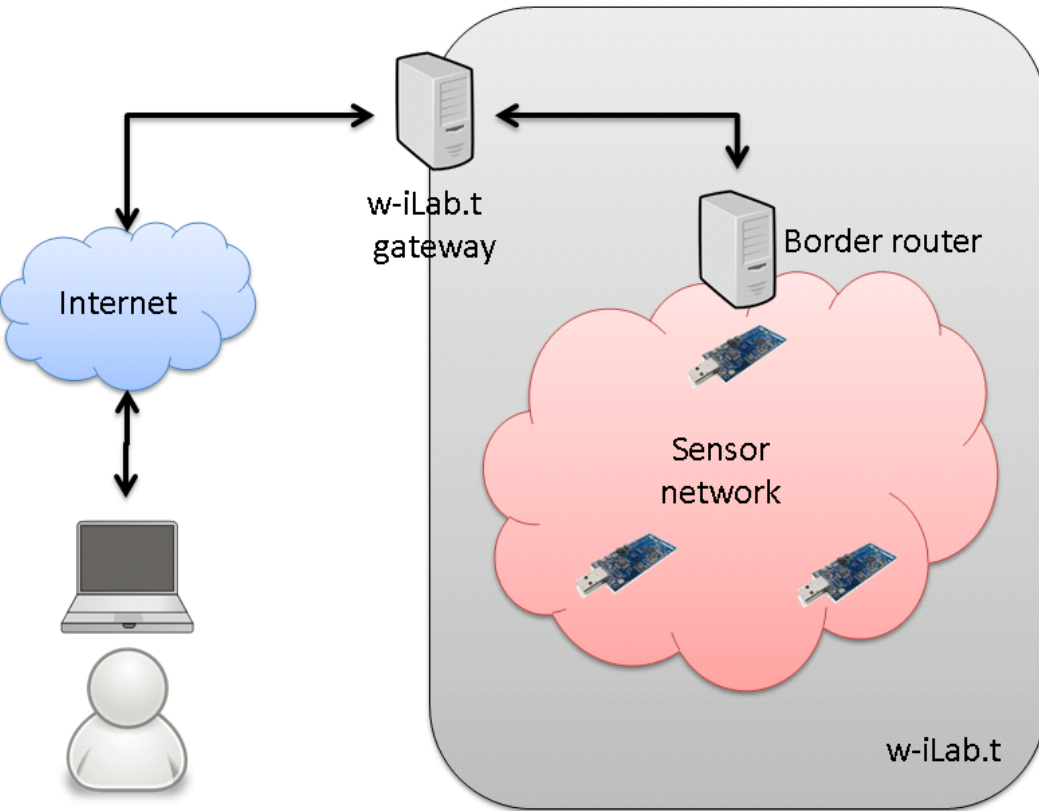


## w-iLab.t: access to the resources

Testbed provides access to bare-metal machines

- Your choice of OS, with full root SSH access
  - Direct IPv6 internet connectivity, IPv4 via NAT
  - Access to sensors (serial, flashing) via native toolchain
- We provide OpenTestbed for orchestration of multiple sensors via MQTT





# Contiki-NG Tutorial

DEPLOYING CONTIKI-NG ON ZOLERTIA SENSORS IN THE W-ILAB.T TESTBED

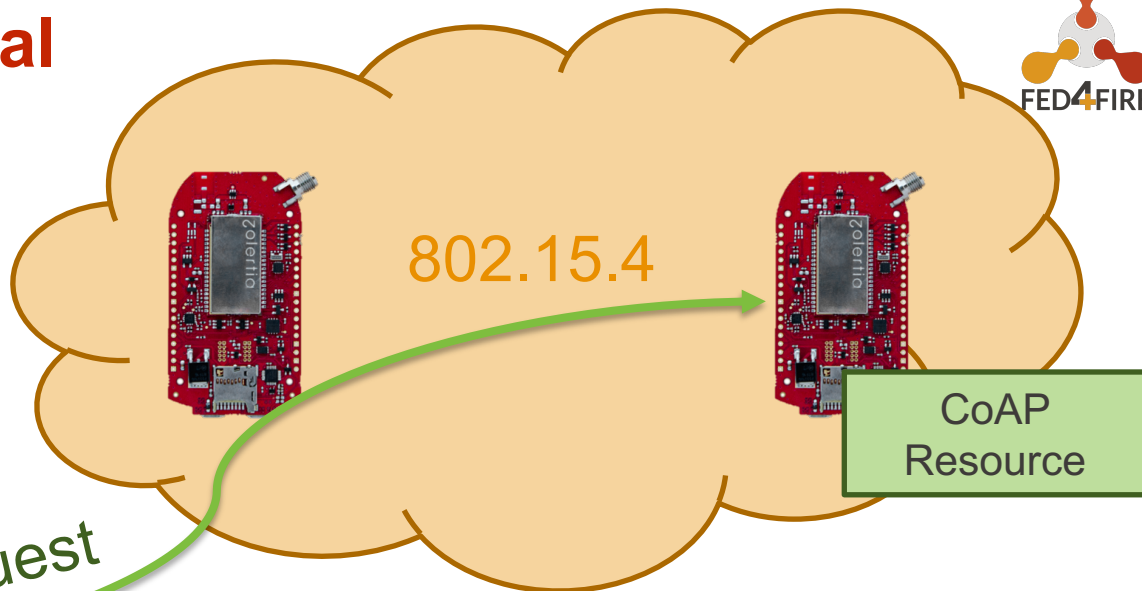
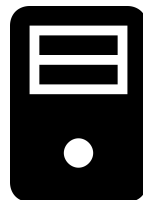
# Contiki-NG Tutorial

## GOAL:

Accessing a CoAP resource in a 802.15.4 wireless sensor network

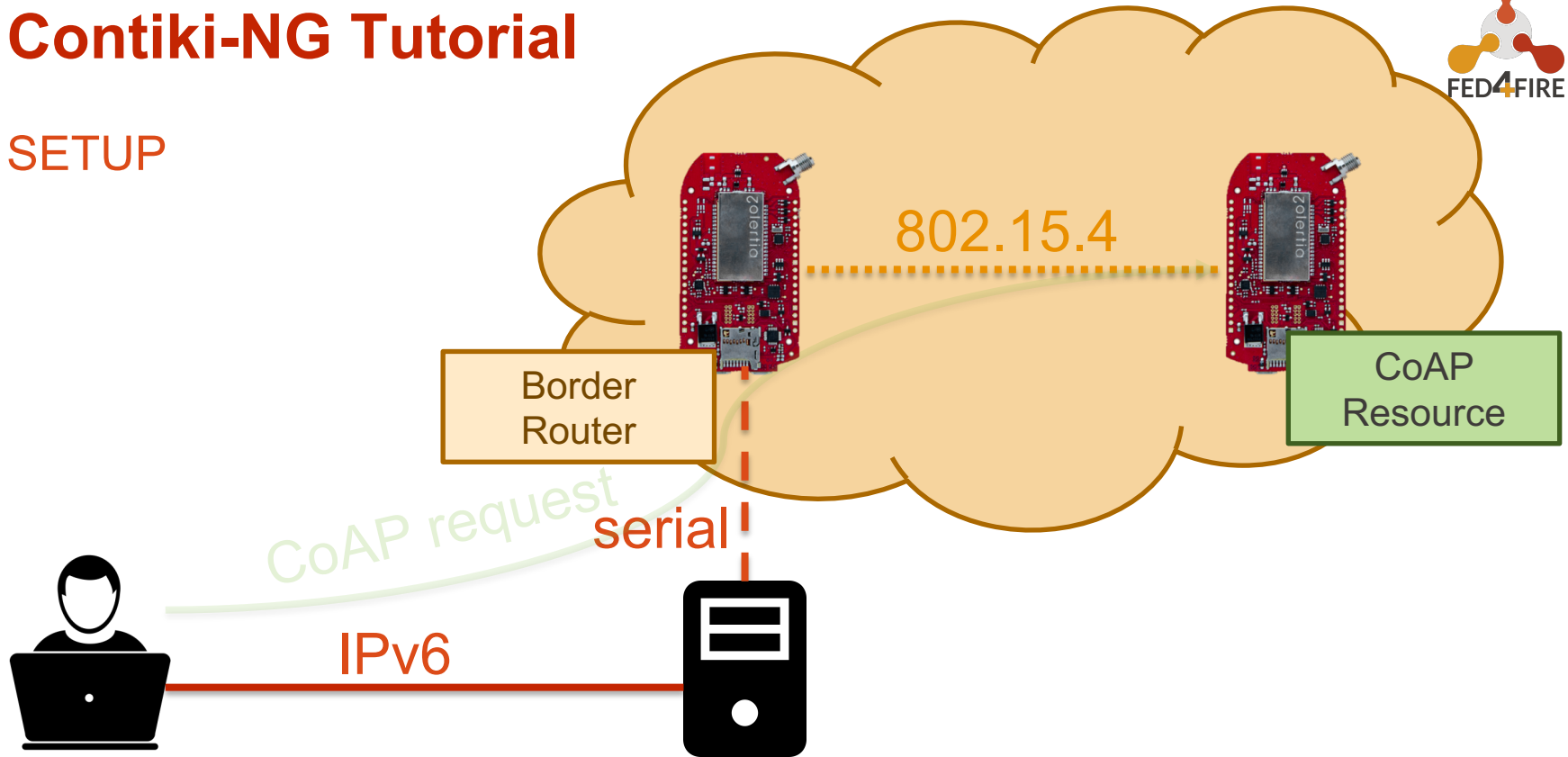


CoAP request



# Contiki-NG Tutorial

## SETUP

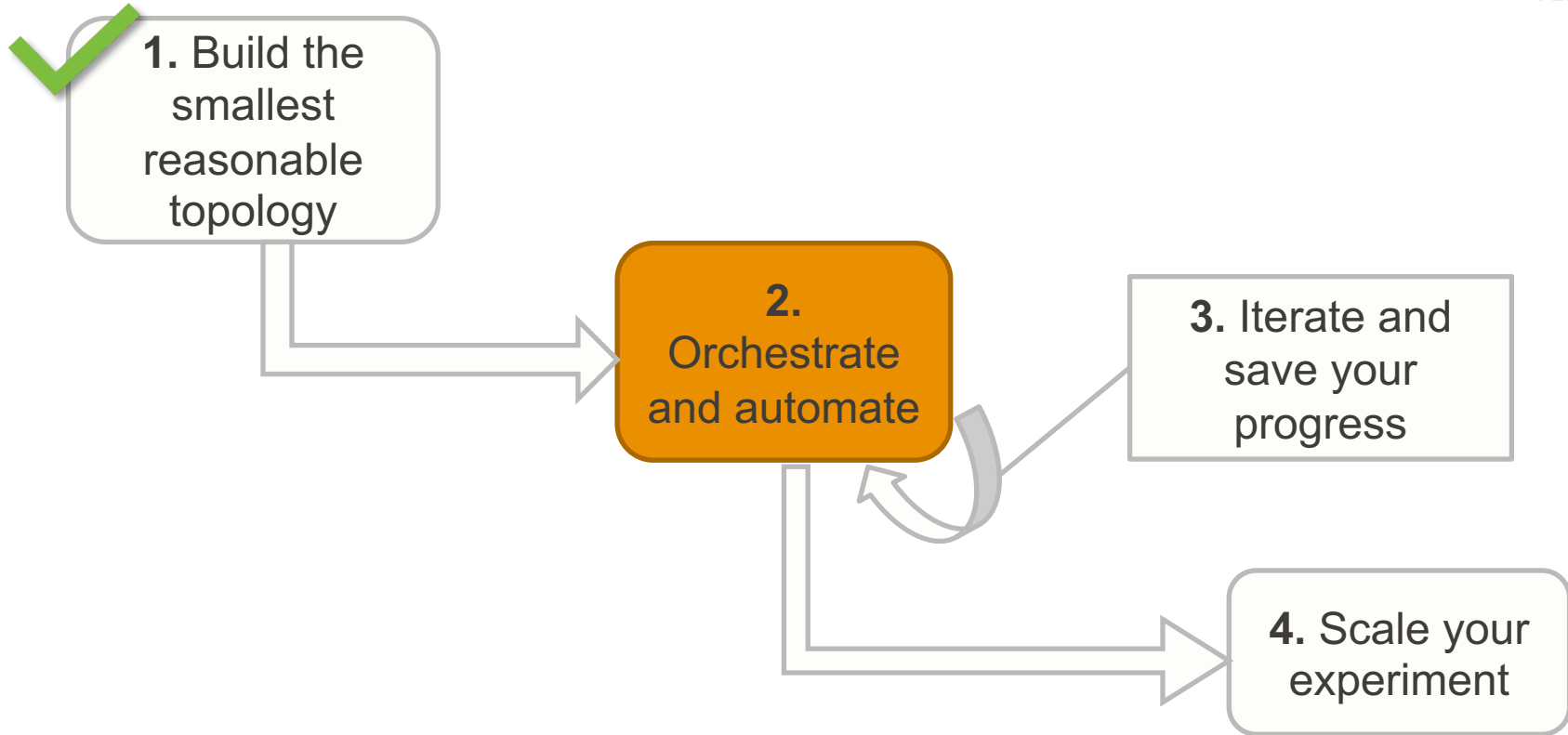




# Scaling up IoT Experiments

USING OPENTESTBED TO SCALE UP YOUR IOT EXPERIMENT

# Recommended Workflow



# Automating and orchestrating your experiment



## GENERIC TOOLS

Use Configuration Management Systems to automate installation and configuration of software

Many tools available for this job: Ansible, Chef, Puppet, ...



# Automating and orchestrating your experiment

## ORCHESTRATING IOT SENSORS WITH OPENTESTBED

- Developed at Inria, Paris for testing OpenWSN firmware
- Adapted for usage at w-iLab.1 testbed

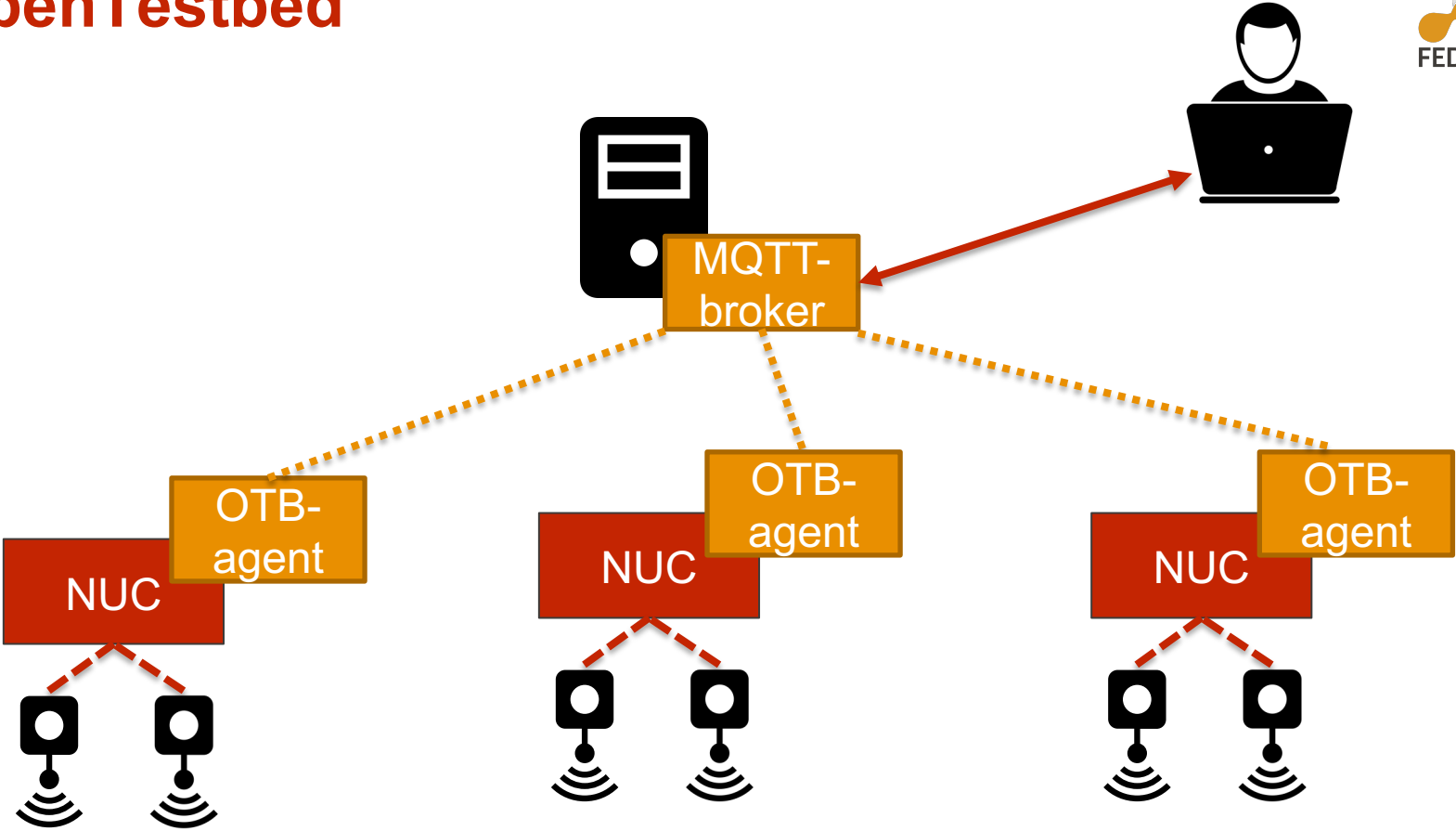
### Features:

- Deployment of firmware images on multiple sensors
- Get output from / Send input to serial consoles
- Lightweight: <1K LOC
- Easy to extend

SOURCE CODE:

<https://github.com/openwsn-berkeley/opentestbed>

# OpenTestbed





# OpenTestbed



## COMMANDS VIA MQTT: EXAMPLE

### Topic:

opentestbed/deviceType/mote/deviceId/01-02-03-04-05-06-07-08/cmd/program

### Payload:

```
{  
  "description": "bsp_eui64",  
  "url": "https://example.com/bsp.ihex",  
  "token": 123  
}
```

### Or:

```
{  
  "description": "01bsp_leds_prog.hex",  
  "hex": "0jAyMDAwMDA0MDAyMERBDUyNDIwMD...",  
  "token": 123  
}
```

# Documentation

## FED4FIRE+

### Testbeds Overview

<https://www.fed4fire.eu/testbeds/>

### Technical Documentation

<https://doc.fed4fire.eu/>

## W-ILAB.T

### Documentation

<https://doc.ilabt.imec.be/ilabt/wilab/>

### Tutorials

<https://doc.ilabt.imec.be/ilabt/wilab/tutorials/>



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[WWW.FED4FIRE.EU](http://WWW.FED4FIRE.EU)